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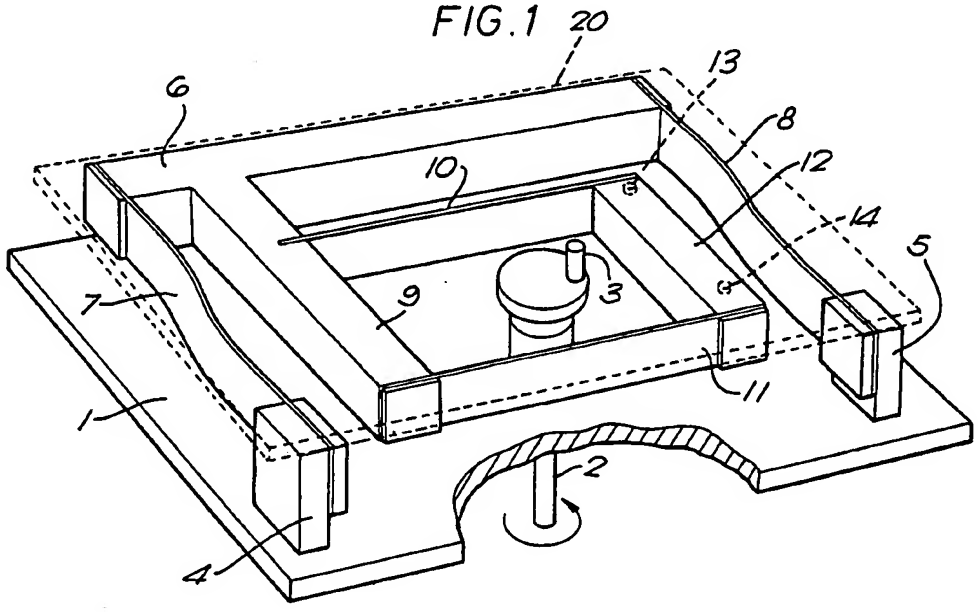
(54) **Orbital platform**

(57) An orbital platform mechanism for laboratory shakers and incubators eg for growing cultures, consists of a base (1), a sample-bearing platform (20) or other support or holder, compliant mounting means (7, 8, 10, 11) supporting the platform from the base to accommodate relative platform oscillation in plural transverse directions, and an electric motor coupled to the platform by a drive shaft 2 and an eccentric (3) for causing circular orbital motion of the platform relative to the base. The compliant mounting means consists of an intermediate support member (6) mounted from the base (1) by means of a first pair of parallel spring metal strips (7, 8), and a platform support member (12) mounted from the intermediate support member (6) by means of a second pair of parallel spring metal strips (10, 11), and the first and second pairs of strips are orthogonally disposed. Additionally or alternatively, the compliant mounting means may comprise pivoted rigid linkages.

FIG.1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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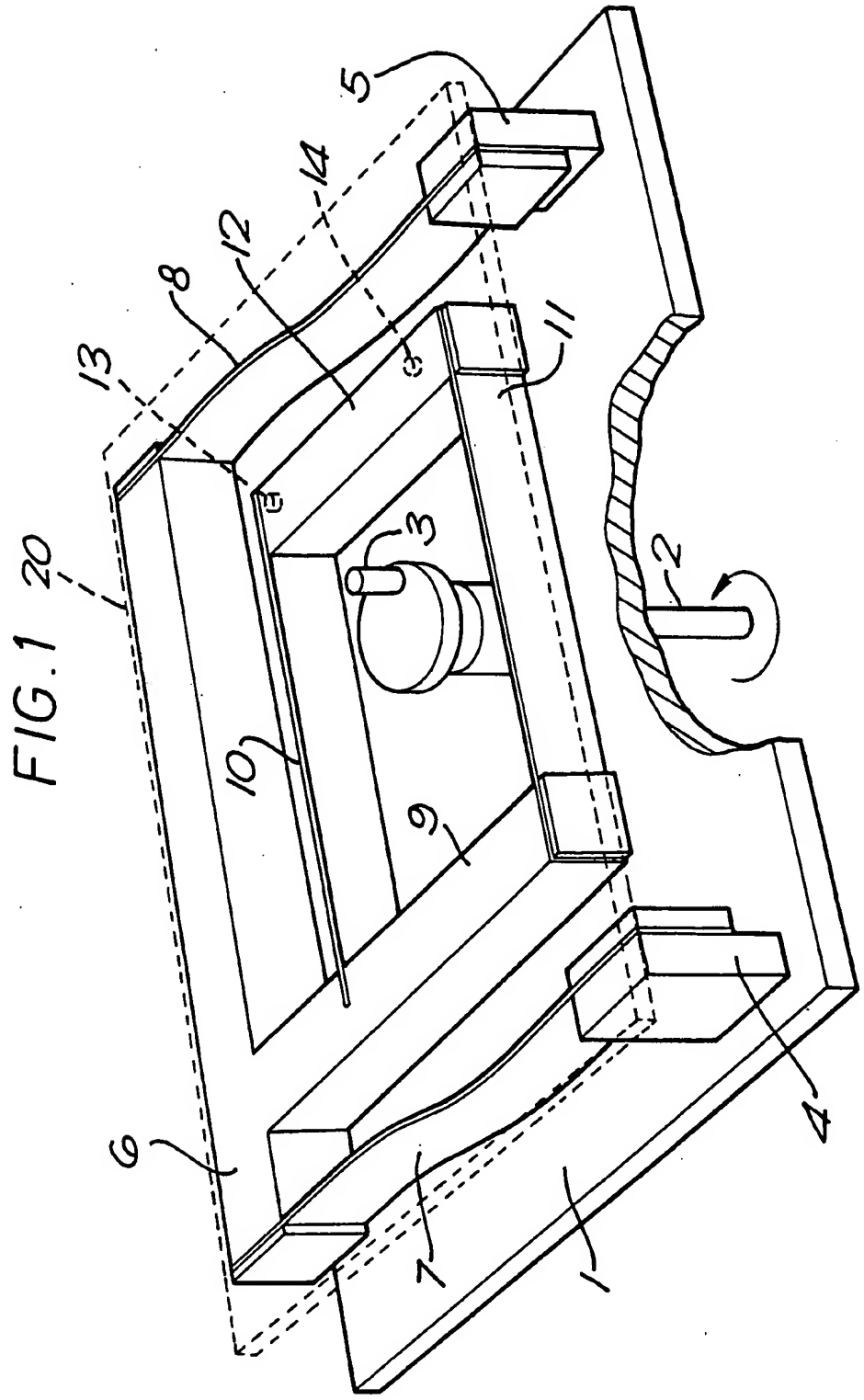

FIG. 1

ORBITAL PLATFORM FOR LABORATORY SHAKERS AND INCUBATORS

Field of the Invention:

This invention relates to orbital platforms for use in, for example, laboratory shakers and incubators.

Background of the Invention:

When growing biological cultures, it is often necessary to gently agitate the suspension liquid. This is required to keep the culture suspension mixed and to improve the absorption of oxygen.

Agitation is, for many applications, most suitably provided by supporting a flask or other container of liquid on a flat horizontal platform which is subjected to orbital motion in the plane of the platform. The orbital motion may follow a variety of patterns, but it is generally found that a circular orbit is suitable.

This motion is conventionally achieved by means of a plurality of eccentric crank mechanisms, each precisely made to match the other eccentrics in radius, angular alignment and location. The bearings of the eccentrics also have to carry the weight and dynamic forces of the platform whilst also

accommodating forces caused by misalignments between the eccentrics.

Conventional orbital platform apparatuses of this type suffer from the disadvantages that they are complex and hence costly to manufacture, involve a large number of components which are prone to wear, and necessitate the use of a comparatively powerful motor.

Objects and Summary of the Invention:

The principal object of the present invention is to provide an orbital platform mechanism which overcomes or at least substantially reduces the abovedescribed disadvantages.

According to one aspect of the present invention, there is provided an orbital mechanism comprising a base, a platform or other support means, drive means for effecting orbital motion of the platform or other support means relative to the base and compliant mounting means supporting the platform or other support means relative to the base, said compliant mounting means including components accommodating motion of the platform or other support means relative to the base in plural transverse directions.

In an exemplary embodiment of the invention which will be described in detail hereinafter, the compliant mounting means comprises a first pair of parallel

compliant linkages connection connecting the base to an intermediate member and a second pair of parallel compliant linkages connecting the intermediate member to the platform, the first and second pairs of linkages being transverse to each other, and preferably being mutually orthogonal, and being arranged in planes substantially parallel to the plane of the platform. The compliant linkages in such an embodiment can be compliant by virtue of being flexible, and also rigid linkages pivotally connected to the base and the intermediate member or to the intermediate member and the platform, as the case may be, may additionally or alternatively be employed.

The first and second pairs of parallel compliant linkages can advantageously be arranged such that one pair lies between the members of the other pair. It is particularly preferred that the second pair of parallel compliant linkages be arranged between the members of the first pair of parallel compliant linkages.

The mounting means is preferably itself capable of supporting the platform and this may conveniently be achieved by forming the linkages as flexible strips, e.g. of steel, of sufficient thickness to support the weight of the platform and of the load placed on it. The stiffness of such strips results in

significant forces being developed when the platform is displaced from its central position. Thus, in a particularly preferred embodiment of the invention, the stiffnesses of the two pairs of strips are made substantially equal such that the resulting force due to displacement of the platform always acts to oppose the displacement. Provided that the orbital motion is circular about the neutral position, then this displacement force will not introduce any significant resistance to the circular motion. Each flexible strip may be a single strip or may be a laminar assembly of more than one strip.

The drive means is preferably an electric motor and may be connected to the platform by various means, e.g. cams and links. It is preferred, however, that the drive means be connected to the platform via a single eccentric crank which can generate a required circular motion of fixed radius. Th drive means may be connected to any part of the platform, since the same motion is imparted to all parts of the platform.

The above and further features of the present invention are set forth with particularity in the appended claims and, together with the advantages thereof, will best be appreciated from consideration of the following detailed description given with reference to the accompanying drawing.

Description of the Drawing:

Figure 1 is a perspective view (partially cut away) of an orbital shaker according to the invention.

Detailed Description of the Embodiment:

Referring to Figure 1, the orbital shaker comprises a base 1, a sample-bearing platform 20 (indicated by the dashed line) and drive means in the form of an electric motor (not shown) connected to the platform by a drive shaft 2 and an eccentric crank 3.

The platform is supported and connected to the base 1 by compliant mounting means comprising two base brackets 4, 5 which are connected to an intermediate bracket 6 by a pair of flexible steel spring strips 7, 8 which allow approximately linear oscillation in the horizontal plane. From an extension 9 of the intermediate bracket 6 are attached two further spring strips 10, 11 which are set perpendicular to the first pair of spring strips 7, 8. The second pair of strips 10, 11 connect the intermediate bracket 6 to a platform support bracket 12 such that the platform support bracket 12 can move with approximate linear motion in the horizontal plane relative to the intermediate bracket 6. The platform is attached to the platform support bracket 12 by means of two bolts 13, 14.

In use, containers of material to be agitated are

placed on the platform and the electric motor is switched on. The motion of the platform support bracket 12 relative to the intermediate bracket 6 is approximately perpendicular to the motion of the intermediate bracket 6 relative to the base brackets 4, 5. This allows the platform support bracket 12 and hence the platform to move with limited rectilinear motion in the horizontal plane by combining flexibility within the two pairs of spring strips 7, 8, 10, 11.

The invention having been described by reference to a particular embodiment, it is to be well appreciated that the invention is not limited to the embodiment described and that modifications and variations thereto are possible without departure from the scope of the invention. For example, the platform of the described embodiment, designed for general purpose use and to accept a variety of shapes and sizes of vessels, may be replaced by a holder designed for a specific application.

CLAIMS:

1. An orbital mechanism comprising a base, a platform or other support means, drive means for effecting orbital motion of the platform or other support means relative to the base and compliant mounting means supporting the platform or other support means relative to the base, said compliant mounting means including components accommodating motion of the platform or other support means relative to the base in plural transverse directions.

2. A mechanism as claimed in claim 1 wherein said compliant mounting means comprises a first plurality of compliant linkages connecting the base to an intermediate member and a second plurality of compliant linkages connecting the intermediate member to the platform or other support means, the first and second pluralities of compliant linkages extending generally transversely to each other.

3. A mechanism as claimed in claim 2 wherein the first and second pluralities of compliant linkages comprise respective pairs of parallel linkages and said first and second pairs of parallel linkages

extend orthogonally with respect to each other.

4. A mechanism as claimed in claim 3 wherein one of the pairs of compliant linkages is disposed between the linkages of the other pair.

5. A mechanism as claimed in any of claims 2 to 4 wherein said compliant linkages are compliant by virtue of being flexible.

6. A mechanism as claimed in claim 5 wherein said compliant linkages comprise spring metal strips.

7. A mechanism as claimed in any of claims 2 to 4 wherein said compliant linkages are compliant by virtue of being pivotally connected to the base and/or the intermediate member and/or the platform or other support means.

8. A mechanism as claimed in any of the preceding claims wherein said drive means comprises an electric motor.

9. A mechanism as claimed in claim 8 wherein the electric motor is coupled to the platform or other support means by means of an eccentric crank.

10. An orbital mechanism substantially as herein described with reference to the accompanying drawing.

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